Preliminary text for discussion only

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Policy options to stimulate R&D in and for developing countries: a comparative view of Latin American experiences.

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Common assumptions and recommendations

It is commonly agreed that research and technology in Latin America is not keeping up with recent changes in science and technology in the world. Accordingly, these countries will face growing difficulties in participating in the new, globalized economy without significant changes in this situation. Three sets of explanations are usually presented to this, each one with its own policy prescription:

a) Governments do not support science and technology as they should. The recommendation is that governments should spend more on science and technology. There are two difficulties associated with this view: the first is that, even if the resources for science and technology increased dramatically, these countries would still lag, given the increasing and much larger expenditures of the central economies. The second difficulty is that this view fails to consider the settings of R&D in different countries – their institutional settings, intellectual resources, and links with other sectors of society. If these settings are not adequate, additional investments in R&D are likely to be wasted.

b) R&D is not very good and should be improved. This explanation goes a step further in interpreting the situation in many areas, and the recommendation is to concentrate efforts and resources in the best quality research groups and institutions, with the adoption of international standards and peer review procedures. This is a very traditional approach, based on the so called "linear model" according to which innovation flows from basic to applied research, and from these to product development. It is well known, however, that this is often not the case. Investments in good quality research, when done outside the framework of a broad policy for scientific and technical innovation, do not go very far, or can lead to the creation of scientific enclaves and the stimulation of brain drain.

c) Science and technology is too academic and should be linked more strongly with the private sector. The assumption is that R&D is "locked in" higher education institutions and government agencies and should be opened to link with the private sector. The notion that the private sector should be stimulated to invest more in R&D (to compensate for the resource limitations of the public sector) is also part of this approach. There are two main difficulties with this view. The first

is that, although it is true than most R&D in Latin American countries is supported by government, and takes place in universities and government institutions, it is not true that most of it is "academic" or unconcerned with applications. On the contrary, evidence from Brazil and other countries shows that most research done in public institutions is applied in intent, even if it is not actually *applied*, due to a variety of reasons that need to be investigated. Secondly, there is the question of how much investment in research and development the private sector is interested in doing in such regions. Most of the high technology companies in developing countries are multinational conglomerates, and such institutions tend to concentrate their R&D efforts in some privileged locations. So, although there is room for innovation everywhere, the likelihood is that innovations developed by large high technology companies in developing regions would be limited to marginal improvements in products, processes, and marketing, rather than in more complex innovations requiring high levels of competence and skills.

Other policy options

If this interpretation is correct, there are three main ways in which scientific and technological innovation can contribute to social and economic development in developing regions. We can mention four of them:

a) To use research and development as a resource for education. This is what happened in large scale in the US and other countries and is also happening in many countries in Latin America. Graduate and research programs are created in universities to provide competence and qualifications for higher education academics, who will in turn qualify their students for the labor market. Research centered universities, according to the traditional Humboldt model, has been a cherished value in Latin American higher education. In practice, research-based higher education remains a minor part of higher education everywhere, and an excessive emphasis on it can go against the need to provide large scale, professional education in non-research institutions. But there is doubt that this kind of research is useful and important.

b) To develop innovation competencies and capabilities for society, without special emphasis on frontier, advanced research, and development. The idea, here, is that small and developing economies cannot really compete with central countries in terms of R&D capabilities but should be able to create an environment that would open the country for the international flow of knowledge, information, and competence. Such a policy would place emphasis on good quality education for the population, with strong emphasis on the knowledge of English; infrastructure for telecommunications and electronic access to data bases and other information assets; interchange programs, support for studies abroad, support for cooperative international projects; and the establishment of friendly physical and institutional

environment for international R&D groups, companies, and firms to come and to set it.

c) To make better use of the public sector as a major buyer and user of local science and technology competencies. This approach has been overlooked but can become very central in any policy for local and national science and technology development. The notion, here, is that the public sector has large and growing needs for scientific and technological development, in areas such as the environment, energy, climate, public health and social conditions – including questions like poverty, education, urban violence and employment – and can be a major buyer and supporter of local research. This, however, is not happening as it could, although governments are already, by and large, the major supporters of higher education in the region.

d) Differential exploration of economic niches. This approach is especially valid for technological specialties such as tropical agronomic sciences and bio-diversity derived biotechnology and pharmaceutical industry. Both have one thing in common: the monopoly over the object of research and innovation, which is local. Several models of research and development in biodiversity biotechnology have been developed in Latin America, some of which have been leading to the growth of not only local expertise, but local markets and local private sector-public research connections not too different from those developed elsewhere.

The Brazilian study

The Brazilian study on "Science and the Public Interest", carried out in 2001, was to see how research and public interest interact, or not, in a few selected areas – agriculture and environment, medications, education, and labor. It was an exploratory study, which included a brief survey of each area, and an analysis of their interactions between research and the public sector. Some of the general findings of the study were:

a) Brazil spends more on applied research than it was usually thought. There are several programs and institutions with a strong research component outside the usual realm of the science and technology agencies, which are not counted as places for science and technology, or only partially considered so. Examples, in the social sciences, at the National Statistical Office (IBGE); the National Institute for Applied Economics Research – IPEA; and the National Institute of Education Research - INEP. Other large agencies are EMBRAPA, in agriculture: Instituto Oswaldo Cruz, in health; and others, outside the scope of this study.

b) It could be expected that these sector institutions worked to respond to the demands of the ministries in which they work. This, however, is not always the case. Frequently:

   a. The Ministry is unable to request research studies, or to use them

   b. The research agency is autonomous, or limited by bureaucratic constraints, and not able or unwilling to respond to the requests from the Ministries

     c. Research groups are established to develop agendas for applied research that get support from science and technology agencies or other sources, but are unable to convince government, or society, to use or adopt their conclusions.

     d. The government co-opts research groups and institutions on the name of applied research, but do not actually use the knowledge produced for any specific purpose.

c) "Public interest" does not always mean an agenda established by the government. There is also public interest when the products of research are used to shape public opinion, or to attend the demands of the private sector. Research groups that respond to this kind of public demand and interests are often more autonomous and self-directed than others.

d) As research groups and institutions prepare to respond more effectively to the public interest, they are bound to change the way they work, and their institutional culture. "Hybrid" or "boundary" institutions are likely to appear, linking research departments or institutions with outside users and clients; or, more often, the research institutions become hybrid, combining academic with entrepreneurial values, and adopting business-like management practices. This trend can have both positive and negative consequences. In some cases, hybrid institutions are much more able to innovate and deliver meaningful products to society than academic ones; in other, entrepreneurial values and attitudes prevail upon academic ones, with undesirable consequences for institutions working under the protection of the state.

e) As Brazil starts to implement a policy of "sector funding" for research and development, the question of how government should relate with the research community and institutions on behalf of the public interest becomes paramount. Ministries should develop their ability to identify, provide support and acquire the knowledge resources they need; research agencies should be allowed to change their shape and composition to respond more readily to the demands; space should be provided for free, undirected, and unsolicited research; creative ways to guarantee relevance and quality at the same time should be combined.

Future work

The first year of the Brazil project was exploratory, opening the way to more precise and well-focused studies in a second phase. Focus brings along the possibility of introducing a comparative perspective, with the participation of researchers in other Latin American countries – Chile, Mexico, Argentina – and the possible support of IDRC. One way of planning for this would be to select some areas of common interest and try to see how different countries are respond to them, in terms of the issues mentioned above: how governments define and look for the knowledge they need; how research institutions respond to these demands; how research institutions respond to other, non-governmental demands – from public opinion, the private sector, international organizations. And how

these new relationships between knowledge users and suppliers affect the way the research institutions work – how they acquire their resources, how they organize and plan for their work, the reward system, how much freedom and oversight they get, etc.

A full research project should work with the four items mentioned above: university research, private-driven innovation, public-driven research, and special niches with public-private partnership. In practice, we would, will have to make some selections, based on the interest of the participants in the project, and the availability of support. One suggestion would be to work with the areas already identified by the Brazilian study, with adjustments. A preliminary list would include the areas of environment, biotechnology, education, public health, and information technology, which was not part of the Brazilian project in the first year. Each participant country team would take one or more of these areas, so that, after a year, all areas would be covered by examples coming from the different participants. For each case study, a selected list of questions should be analyzed. For instance

- The "clients" or users of the research activity – government, companies, public opinion, or combinations of these.

- How the need to respond to clients' demands affect the way the institution is organized: management, financing, leadership, etc.

- What kinds of special technologies and approaches are being developed to attend to these specific clients - in other word, how the research content is affected by this condition.

- Insertion in the national and international scientific community – questions of publication, interchange, proprietary knowledge, intellectual property, and so on.